2/2/16

"Challenges are what make life interesting and overcoming them is what makes life meaningfu

-Joshua J. Marine

HW: "Exponential Growth and Decay" w/s #1-11 odd, 12

AIM: What is Exponential Growth and Decay ?

Warm Up:

1)

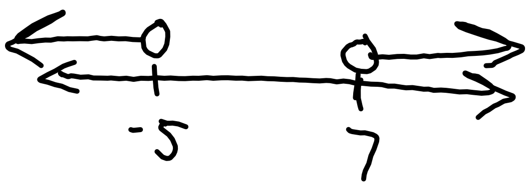
Express the solution in set builder, and interval notation: $x^2 - 22 > 13 + 2x$

$-2x-13 \quad -13-2x$

$x^2-2x-35>0$ open (positives) GOLI

$(x-7)(x+5)>0$

$7 \quad -5$



SB: $\{x \mid x<-5 \text{ or } x>7\}$

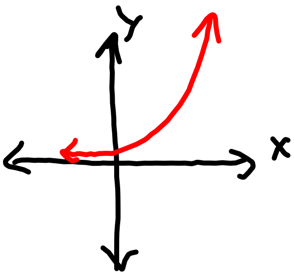
Int: $(-\infty,-5)\cup(7,\infty)$

I. $f(x) = ab^x$ is and exponential function where b is called the base

Exponential Growth

ex. $f(x) = 2^x$.

$b > 1$

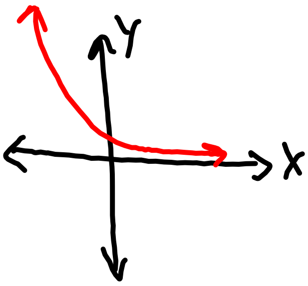


⊛ Asymptote
$y = 0$

Exponential Decay

Ex. $f(x) = \left(\frac{1}{2}\right)^x$.

$0 < b < 1$



Asymptote: $y = 0$

Label each of the following as exponential growth, or decay:

1) $f(x) = 3^x$ G

2) $f(x) = .2^x$ D

3) $f(x) = 5.7^x$ G

4) $f(x) = \left(\frac{22}{7}\right)^x$ G

5) $f(x) = 3^{-x}$

$f(x) = \left(\frac{3}{1}\right)^{-x}$

$f(x) = \left(\frac{1}{3}\right)^x$

Decay

6) $f(x) = 77^{-x}$

$f(x) = \left(\frac{1}{77}\right)^x$

Decay

Asymptote: A value that a function gets closer to, but never touches.

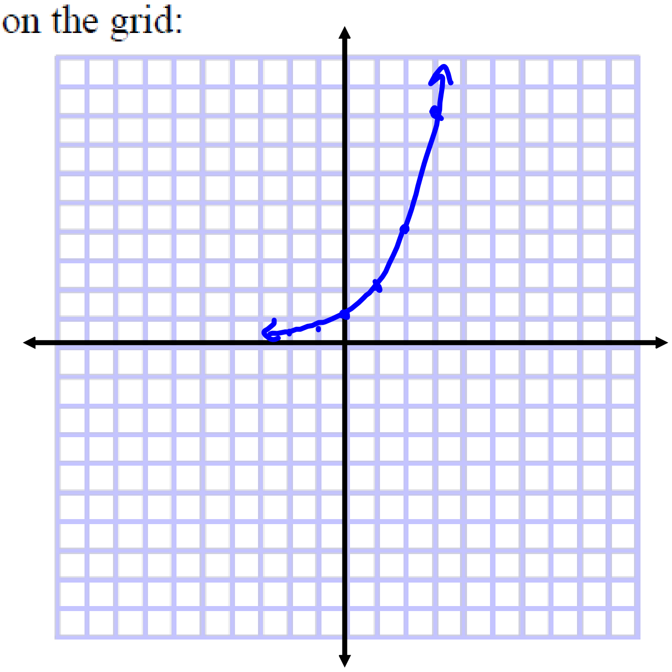
II.

1. Sketch the graph of $f(x) = 2^x$ on the grid:

Table of values:

$f(x) = 2^x$

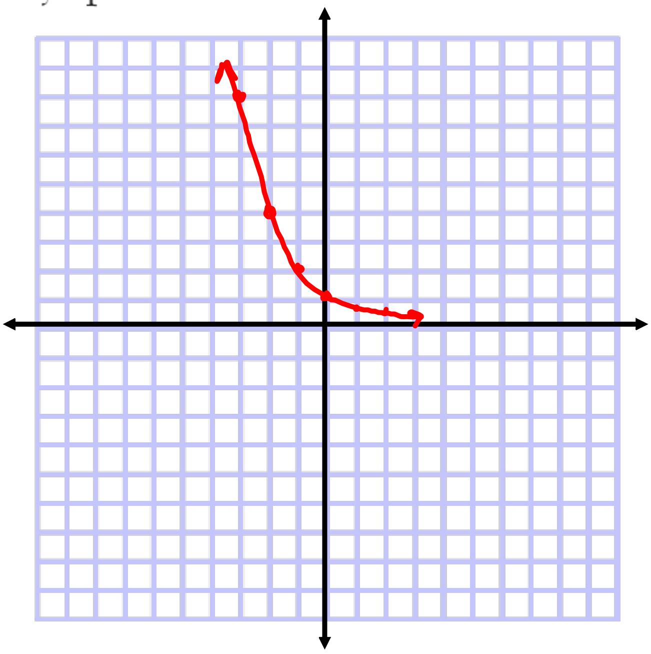
x	y
-2	1/4
-1	1/2
0	1
1	2
2	4
3	8



2. The graph of the equation $y = \left(\frac{1}{2}\right)^x$ has an asymptote. On the grid below, sketch $y = \left(\frac{1}{2}\right)^x$ and write the equation of this asymptote.

x	y
-3	8
-2	4
-1	2
0	1
1	½
2	¼

Asymptote:
y = 0



III. Applications for exponential growth and decay. A very popular base is e.

1) Inspect the graph of $f(x) = e^x$.

The base e is used in calculating **compound interest**, which you will study in detail later.

2) Here is an example involving **compound interest**.

Matt places $1,200 in an investment account earning an annual rate of 6.5%, compounded continuously. Using the formula $V = Pe^{rt}$, where V is the value of the account in t years, P is the principal initially invested, e is the base of a natural logarithm, and r is the rate of interest, determine the amount of money, to the *nearest cent*, that Matt will have in the account after 10 years.

V= Final value

P= Starting Amount

r= interest rate

t= time

V= ?

P= 1200

r= 6.5% = .065

t= 10 years

$V = Pe^{rt}$

$V = 1200e^{(.065)(10)}$

V= $2298.65

Growth = $P\left(1+\frac{r}{n}\right)^{nt}$ Decay = $P\left(1-\frac{r}{n}\right)^{nt}$

4) A radioactive substance has an initial mass of 100 grams and its mass halves every 4 years. Which expression shows the number of grams remaining after t years?

(1) $100(4)^{\frac{t}{4}}$
(3) $100\left(\frac{1}{2}\right)^{\frac{t}{4}}$
(2) $100(4)^{-2t}$
(4) $100\left(\frac{1}{2}\right)^{4t}$

Decay
$100\left(\frac{1}{2}\right)^{\frac{t}{4}}$

6) Mr. Carman can drum 910 single strokes in one minute. Each year, the number of single strokes he can play decreases by 1%. Which function models this situation? (Use t for years)

(1) $f(x) = 910\left(\frac{99}{100}\right)^t$
(3) $f(x) = 910\left(\frac{1}{100}\right)^t$
(2) $f(x) = 910^t$
(4) $f(x) = yes$

8) The graph of $f(x)$ is constantly decreasing, but it will never actually achieve a value of zero. Which **behavior** does $f(x)$ model?

(1) exponential growth
(3) a craving for *cheeze-it's*
(2) exponential decay
(4) relationship breakup denial

10) Mr. Carman's bunny making machine has gone hay-wire. It is creating bunnies at a rate that can be modeled by the equation $B(x) = 5(2)^x$, where x is the number of minutes since he turned the machine on, and $B(x)$ is the number of bunnies.

a] How many bunnies will Mr. Carman have after 4 minutes?

b] **THINK**: How many bunnies did Mr. Carman start out with?